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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the optical information record regenerative apparatus which has an optical head containing the laser diode formed through the insulating layer on the semi-conductor substrate.

[0002]

[Description of the Prior Art] With the optical information record regenerative apparatus which irradiates an optical spot and performs informational record and playback on an information record medium, it is made to reproduce data by a laser diode being used as the light source of an optical head, and recording by modulating the outgoing radiation light from this laser with record data, and irradiating as an optical spot on an information record medium, and receiving the reflected light from a record medium with a photodiode.

[0003] The deer was carried out, the pickup (accumulation mold pickup) which formed the laser diode (Following LD and abbreviation) and the photodiode (Following PD and abbreviation) on the same semi-conductor substrate can be considered on the optical head conventionally used for such an optical information record regenerative apparatus, and performing miniaturization and low cost-ization of equipment is examined.

[0004] however, in such accumulation mold pickup So that interference between LD and PD and assembly nature may pose a problem and it may be indicated by JP,59-96789,A as what solves this problem When preparing LD and PD on the same semi-conductor substrate, an insulator layer is made to intervene between a semi-conductor substrate and LD, and there is a thing it was made to raise assembly-operation nature at the same time it separates the electrical connection between LD-PD which poses a problem at the time of the output control of LD.

[0005] By the way, such accumulation mold pickup Among record regenerative apparatus including a compact disk, especially when using it for disk units which can be written in, such as a magneto-optic disk and a phase change disk Since LD noise which may modulate LD output at high speed according to data for the writing of data, and poses a problem in such a disk unit at the time of read-out of data is reduced, RF superposition may be performed and LD may be driven on the very high frequency of hundreds of MHz. (About RF superposition, it is introduced, for example by JP,56-37834,A etc.)

[0006]

[Problem(s) to be Solved by the Invention] However, the thing indicated by JP,59-

96789, A Reference is not made at all about performing the RF superposition for reducing LD noise which modulates LD output at high speed, or poses a problem according to write-in data at the time of read-out of data. Therefore, about such accumulation mold pickup, if it is going to carry out the high-speed modulation of the LD as it is The insulating layer between LD and a semi-conductor substrate will act as a capacitor (capacity), the high frequency current will flow into a semi-conductor substrate side through an insulating layer, and it will become impossible to perform a high-speed modulation, without the high frequency current flowing to the LD side.

[0007] Therefore, there was a trouble the data writing in a high speed not only becoming impossible but that the dependability of read-out actuation was not acquired from the ability of RF superposition not to fully be performed.

[0008] This invention aims at offering the optical information record regenerative apparatus which has an optical head containing the laser diode formed through the insulating layer on the semi-conductor substrate whose data writing in a high speed was made in view of the above-mentioned situation, and is attained. In addition to said purpose, other purposes of this invention are just going to improve the dependability of data read-out actuation.

[0009]

[Means for Solving the Problem] According to this invention, using the optical head containing the laser diode formed through the insulating layer on the semi-conductor substrate, an information signal is recorded, and the electrode by the side of said insulating layer is made into constant potential rather than the barrier layer of said laser diode, and in the optical information record regenerative apparatus to reproduce, it is constituted so that the laser diode driving means which impresses a modulating signal to the electrode of another side of said laser diode may be established.

[0010] Moreover, according to this invention, it is constituted so that the electrode by the side of said insulating layer may be made into this potential rather than the barrier layer of said semi-conductor substrate and said laser diode. Moreover, according to this invention, it is constituted so that a means to impress a RF signal to the electrode of another side of said laser diode may be established.

[0011] Moreover, according to this invention, the laser diode is directly formed on said insulating layer. Moreover, according to this invention, the laser diode is formed through conductive submounting on said insulating layer.

[0012]

[Function] Consequently, it can be made hard for it to become only the electrode of another side of a laser diode that electrical-potential-difference change arises even if it changes the drive current of a laser diode with a modulating signal, since according to this invention the electrode by the side of said insulating layer is made into constant potential and it come to impress a modulating signal to the electrode of another side rather than the barrier layer of the laser diode formed through the insulating layer on the semi-conductor substrate, and to flow in a RF drive current to an insulating layer.

[0013] Moreover, it can be made hard for it to become only the electrode of another side of a laser diode that electrical-potential-difference change will arise if the drive current of a laser diode is changed with a modulating signal also by making the electrode by the side of said insulating layer into this potential rather than the barrier layer of a semi-conductor substrate and a laser diode according to this invention, and to flow in a RF

drive current to an insulating layer.

[0014] Moreover, the high frequency current can make it hard to flow in to an insulating layer by establishing a means to superimpose a RF signal on the electrode of another side of a laser diode according to this invention.

[0015] Moreover, according to this invention, a configuration is possible for an easy thing by forming a laser diode directly on an insulating layer. Moreover, according to this invention, heat can be radiated good in a laser diode by forming a laser diode through conductive submounting on said insulating layer.

[0016]

[Example] Hereafter, the example of this invention is explained according to a drawing. (The 1st example) Drawing 1 shows the optical head of the optical information record regenerative apparatus with which this invention is applied, and shows a part of accumulation mold pickup which formed in one the laser diode formed through the insulating layer on the semi-conductor substrate, and the photodiode for carrying out the direct monitor of the outgoing radiation light from this laser diode here.

[0017] Moreover, the 1st example shows the case where a laser diode output is modulated at high speed according to write-in data. drawing -- setting -- 1 -- the semi-conductor substrate of n mold -- it is -- this semi-conductor substrate 1 -- one field -- crevice 1a is mostly formed in a center section. This crevice 1a forms that side attachment wall in the shape of a taper. Moreover, the electrode 2 is connected to the field of another side of the semi-conductor substrate 1.

[0018] The laser diode 4 is formed in the crevice 1a base of the semi-conductor substrate 1 through an insulating layer 3. 41 shows the barrier layer of a laser diode 4 here. And the electrode 5 was connected to the side which is in contact with the insulating layer 3 of a laser diode 4, the electrode 6 was connected to the side which is not in contact with the insulating layer 3 of a laser diode 4, and the npn transistor 7 which impresses the modulating signal which modulates the output of a laser diode 4 is connected to this electrode.

[0019] p mold field for on the other hand forming a photodiode 8 in the side-attachment-wall section of crevice 1a which counters the laser diode 4 of the semi-conductor substrate 1 between the n-type-semiconductor substrates 1 is prepared. This photodiode 8 is for carrying out the monitor of the outgoing radiation light from a laser diode 4. Moreover, the electric resistance 9 which carries out electrical-potential-difference conversion and detects the photocurrent of this photograph tie ODO 8 was connected to the photodiode 8, and PD monitor terminal 10 for carrying out the monitor of the photocurrent of photograph tie ODO 8 to this electric resistance 9 at the node of photograph tie ODO 8 is connected to it.

[0020] Drawing 2 shows the circuitry of the accumulation mold pickup constituted in this way. In this case, the n-type-semiconductor substrate 1 and the photodiode 8 constituted by p mold field are connected to the monitor terminal 10 while it connects a cathode to the electrode 2 of the semi-conductor substrate 1 and grounds an anode through electric resistance 9.

[0021] Moreover, the laser diode 4 made the anode the side which touches an insulating layer 3, it connected with the electrode 5, and it made the cathode the side which is not in contact with an insulating layer 3, and has connected the npn transistor 7 through an electrode 6.

[0022] And constant potential, +5V [for example,], is connected to the electrode 5 of the side which is in contact with the electrode 2 of the n-type-semiconductor substrate 1, and the insulating layer 3 of a laser diode 4, respectively. In this case, although it is not necessary to connect with this potential, since the supply voltage which can generally be used with equipment is restricted that what is necessary is just constant potential, respectively, it connects with +5V here [both], and the electrode 2 and the electrode 5 have this potential. Moreover, an electrode 2 and an electrode 5 are connected in the pickup 11 interior, and you may make it connect this node to +5V.

[0023] And he is trying to give the modulating signal for modulating the output of a laser diode 4 at the base of a npn transistor 7 at high speed according to write-in data. Next, actuation of the example constituted as mentioned above is explained.

[0024] In this case, +5V are impressed to the electrode 5 of the side which is in contact with the electrode 2 of the n-type-semiconductor substrate 1, and the insulating layer 3 of a laser diode 4, respectively, in this condition, a modulating signal is given to the base of a npn transistor 7, and the drive current of a laser diode 4 is changed at high speed according to write-in data. Then, the outgoing radiation light of a laser diode 4 is modulated at high speed according to the modulating signal at this time, the record medium which is not illustrated through the optical system which is not illustrated irradiates as an optical spot, and data logging comes to be performed.

[0025] In this case, even if it changes the base electrical potential difference of a npn transistor 7 with a modulating signal at high speed and changes the drive current of a laser diode 4 from the double-sided part of an insulating layer 3 being maintained by the always same electrical potential difference (+5V) for data writing, that electrical-potential-difference change arises becomes only the electrode 6 which is not in contact with the insulating layer 3 of a laser diode 4, and the high frequency current stops being able to flow in easily to an insulating layer 3.

[0026] Therefore, according to such 1st example, since it was made hard to make both sides of an insulating layer 3 into this potential, and to flow in a RF drive current to an insulating layer 3, the drive current of a laser diode 4 can be modulated now at high speed, and, thereby, data write-in actuation at a high speed is attained. Moreover, since the npn transistor which is easy to give the property which was excellent on the process as a modulation element can be used, in the optical disk unit for which the current change by the high speed and the high current is needed, it is very advantageous. Moreover, since he is trying to form a laser diode directly on an insulating layer, a configuration is also possible for an easy thing.

[0027] In addition, a photodiode 8 is not constituted on the semi-conductor substrate (this example n-type-semiconductor substrate 1) with which a laser diode 4 is laid, but may serve as another object.

(The 2nd example) In the accumulation mold pickup stated by drawing 1 , the 2nd example shows the case where RF superposition is performed, in order to reduce the noise of the laser diode output which poses a problem at the time of read-out of data.

[0028] Drawing 3 attaches and shows a same sign to the same part as drawing 2 , and constitutes the laser diode 4 and the photodiode 8 as a high frequency superposition module 14 in this case with the high frequency superposition circuit which consists of a capacitor 12 and a source 13 of an oscillation.

[0029] A capacitor 12 the thing and the source 13 of an oscillation which cut a dc

component here It is what outputs the high frequency to superimpose. The high frequency superposition circuit of these capacitors 12 and the source 13 of an oscillation While connecting with the electrode 6 side which is not in contact with the insulating layer 3 of a laser diode 4 He is trying to prevent the RF noise which suppresses attenuation to the minimum and emits it by carrying out a modularization with a laser diode 4 and a photodiode 8 even when the RF to superimpose becomes high with hundreds of MHz.

[0030] If +5V are impressed to the electrode 5 of the side which carried out the deer and is in contact with the electrode 2 of the n-type-semiconductor substrate 1, and the insulating layer 3 of a laser diode 4 also in this case, respectively, the double-sided part of an insulating layer 3 Since it is maintained by the always same electrical potential difference (+5V), to the side which is not in contact with the insulating layer 3 of a laser diode 4 In order that the RF superposition circuit of the source 13 of an oscillation may be connected with a capacitor 12 and the output of a laser diode 4 may carry out noise reduction, even if it superimposes a RF, that electrical-potential-difference change arises Become only the electrode 6 of the side which is not in contact with the insulating layer 3 of a laser diode 4, the high frequency current stops being able to flow in easily to an insulating layer 3, and a RF can be efficiently superimposed now.

[0031] In addition, since the high frequency at the time of data read is superimposed, the switching circuit (not shown) is connected to the high frequency superposition circuit. About this switching circuit, JP,63-90037,A etc. is detailed.

[0032] Moreover, what is necessary is just to connect the transistor 7 for a modulation to the electrode 6 of the side which is not in contact with the insulating layer 3 of a laser diode 4 like the 1st example, although it is necessary to write in also in this case and to modulate the drive current of a laser diode 4 according to data.

[0033] Moreover, at the time of data read, a direct current signal is impressed to a npn transistor 7, and a modulating signal is impressed at the time of data writing. Therefore, since according to such 2nd this example both sides of an insulating layer 3 are made into this potential, a high frequency superposition circuit is connected to the side which is not in contact with the insulating layer of a laser diode 4 and it is made to superimpose high frequency at the time of the read of data, the high frequency current from the source 13 of an oscillation stops being able to flow in easily to an insulating layer 3, and can superimpose on a laser diode 4 efficiently. Thereby, the output noise of a laser diode 4 can decrease effectively, and becomes possible [carrying out data read-out to stability]. Moreover, at the time of record of data, since a RF superposition signal stops and a modulating signal joins a laser diode 4, it will be in the same condition as the 1st example.

(The 3rd example) When a high frequency superposition module is constituted like the 2nd example, the high frequency current from the source 13 of an oscillation will flow into a photodiode 8 side as the leakage current 16 by large **** of the capacity component 15 between the laser diodes 4 and photodiodes 8 which contain an insulating layer 3 as shown in drawing 4 . Since this leakage current 16 flows for the same path as the original photocurrent of a photodiode 8, it has the case where it becomes impossible for the photocurrent of a photodiode 8 to detect correctly.

[0034] Then, he is trying to mitigate the bad influence by the leakage current in the case of high frequency superposition module connection in the 3rd example. Drawing 4 attaches and shows a same sign to the same part as drawing 3 , and has connected the

capacitor 17 as a means which has capacity between touch-down the in-contact [side / with the insulating layer 3 of the laser diode 4 in a high frequency superposition module]-in this case, i.e., anode, side. This capacitor 17 is good to choose it as a desirable bigger capacity than the capacity component 15 between a laser diode 4 and a photodiode 8.

[0035] The leakage current 16 which is going to flow to a photodiode 8 side can be removed or decreased through a capacitor 17 through the capacity component 15 between a laser diode 4 and a photodiode 8 by having carried out the deer and having connected the capacitor 17 with a big capacity to the side which is in contact with the insulating layer 3 of a laser diode 4 in this case.

[0036] In addition, although it is necessary to write in also in this case and to modulate the drive current of a laser diode 4 according to data, a modulation rate does not fall by addition of a capacitor 17 in this case that what is necessary is just to connect the transistor 7 for a modulation to the electrode 6 of the side which is not in contact with the insulating layer 3 of a laser diode 4 like the 2nd example.

[0037] Therefore, according to such 3rd this example, by having connected the capacitor 17 of a bigger capacity than the capacity component 15 between a laser diode 4 and a photodiode 8 to the side which is in contact with the insulating layer of a laser diode 4, even when it is lost that the high frequency current flows as the leakage current 16 to a photodiode 8 side and RF superposition is performed, it is stabilized and detection of the quantity of light by the photodiode 8 can be performed.

[0038] In addition, it is good to connect a capacitor with the same location as the 3rd example if needed also in the configuration of the 1st example. Moreover, although the semi-conductor substrate 1 was used as the n-type-semiconductor substrate in the 1st - the 3rd example which were mentioned above, this may be a p type semiconductor substrate. What is necessary is just to make it drive the drive terminal of a laser diode 4 like old explanation also in this case from the side which is not in contact with an insulating layer 3, i.e., separated from the substrate 1. Moreover, the polarity of a laser diode 4 and the mounting direction do not need to be the same as this example.

[0039] Moreover, this invention can apply the photodiode which receives the laser beam which outgoing radiation was carried out from the laser diode, and was reflected from the record medium to the accumulation mold pickup formed in one, respectively besides the laser diode formed through the insulating layer on the semi-conductor substrate, and the photodiode which carries out the direct monitor of the outgoing radiation light from this laser diode.

[0040] Drawing 5 shows the outline configuration of such accumulation mold pickup. In this case, 21 is a semi-conductor substrate and has formed the laser diode 22 through the insulating layer 221 on this semi-conductor substrate 21.

[0041] On the semi-conductor substrate 21, the laser diode 22 was approached and the photodiode 23 is formed. This photodiode 23 is for carrying out the direct monitor of the outgoing radiation light from a laser diode 22. Moreover, on the semi-conductor substrate 21, it detached more slightly than a laser diode 22, and the photodiode 24 is formed. This photodiode 24 is for receiving the reflected light from the recording track side 291 of the record medium 29 mentioned later.

[0042] The laser diode 22 was approached and the total reflection mirror 25 is formed. This mirror 25 carries out total reflection of the laser beam by which outgoing radiation is carried out along with the 21st page of a semi-conductor substrate from a laser diode 22

to the 21st page of a semi-conductor substrate, and a perpendicular direction. And the laser beam in which total reflection was carried out by the mirror 25 is given to the beam splitter 26 formed from the hologram.

[0043] In a beam splitter 26, from a mirror 25, the laser beam given from a perpendicular direction is outputted up as it is, and is given to a collimator lens 27. And he makes it parallel light by the collimator lens 27, and is trying to irradiate the recording track side 291 of a record medium 29 through an objective lens 28.

[0044] On the other hand, the reflected light from the 291st page of the recording track of a record medium 29 is given to **** and reverse through an objective lens 28 and a collimator lens 27 at a beam splitter 26. He deflects and outputs only a predetermined include angle about the reflected light from a collimator lens 27, and is trying to receive the reflected light from the recording track side 291 of a record medium 29 with a photodiode 24 in a beam splitter 26.

[0045] The same effectiveness can be expected to have mentioned above by carrying out a deer and applying the 1st - the 3rd example which were mentioned above also about the accumulation mold pickup constituted in this way.

(The 4th example) A part of accumulation mold pickup which formed in one the prism which is made to reflect drawing 6 in the laser diode formed on conductive submounting through the insulating layer on the semi-conductor substrate and the storage which does not illustrate the outgoing radiation light from this laser diode, and leads the reflected light from an optical recording medium to a photodiode, and the photodiode which detects the reflected light from an optical recording medium is shown.

[0046] In drawing, 31 is the semi-conductor substrate of n mold, and forms the insulating layer 32 on this semi-conductor substrate 31. And the laser diode 34 is formed through the submounting 33 on this insulating layer 32. The submounting 33 consists for example, of an Si substrate, and it is prepared in order to make easy heat dissipation and optical adjustment of a laser diode 34. Of course, the thing of the presentation of those other than Si substrate may be used for the submounting 33.

[0047] In addition, 341 is the barrier layer of a laser diode 34. Rather than the barrier layer 341, the electrode 35 was connected to the insulating-layer 32 side, and the electrode 36 is connected to a laser diode 34 on another side of an insulating layer 32 and the opposite side. And the npn transistor 37 which impresses the modulating signal which adjusts the output of a laser diode 34 is connected to this electrode 36.

[0048] The side of the laser diode 34 here to which the anode and the electrode 36 are connected for the side to which the electrode 35 is connected is a cathode. On the other hand, on the insulating layer 32 of the semi-conductor substrate 31, the laser diode 34 was countered and prism 38 is arranged. And the photodiodes 39 and 39 by p mold field are formed in semi-conductor substrate 31 part which counters this prism 38 inferior surface of tongue through an insulating layer 32. These photodiodes 39 and 39 detect the reflected light from the optical recording medium which is not illustrated, are for obtaining a regenerative signal, a servo error signal, etc., and have two or more light-receiving sides divided, respectively.

[0049] And +5V are connected to the electrode 35 by the side of an insulating layer as a constant voltage, respectively rather than the electrode 30 of the semi-conductor substrate 31 of n mold, and the barrier layer 341 of a laser diode 34. In this case, if the electrical potential difference of these electrodes 30 and 35 is a constant voltage, it does not need to

be this potential. However, since the supply voltage which can generally be used with equipment is restricted, it has this potential of +5V here [both]. Moreover, these electrodes 30 and 35 are connected inside pickup, and you may make it connect this node to +5V.

[0050] And he is trying to give the modulating signal for carrying out the high-speed modulation of the output of a laser diode 34 according to write-in data to the base of a npn transistor 37. Drawing 7 shows the circuitry of the accumulation mold pickup constituted in this way.

[0051] In this case, the laser diode 34 connected the anode to the electrode 35, and has connected the npn transistor 37 for the cathode through an electrode 36. Moreover, photodiodes 39 and 39 connect a cathode to the electrode 30 of the semi-conductor substrate 31 in common, and it enables it for the photocurrent from an anode to detect the quantity of light which each photodiodes 39 and 39 received.

[0052] Next, actuation of the example constituted as mentioned above is explained. If a modulating signal is given to the base of a npn transistor 37 also in this case and the drive current of a laser diode 34 is changed at high speed according to write-in data, the outgoing radiation light of a laser diode 34 will be modulated at high speed according to the modulating signal at this time, the record medium which is not illustrated through the optical system which is not illustrated will irradiate as an optical spot, and data logging will be performed.

[0053] In this case, it becomes only the electrode 36 by the side of an insulating layer 32 and reverse that electrical-potential-difference change produces them even if they change the drive current of a laser diode 34 at high speed, since the double-sided part 31 of an insulating layer 32, i.e., a semi-conductor substrate, and the submounting 33 are maintained by the always same electrical potential difference (+5V), in view of a barrier layer 341, and the high frequency current stops being able to flow in easily to an insulating layer 32.

[0054] Therefore, also according to such 4th example, since it was made hard to make insulating-layer 32 both sides into this potential, and to flow in a RF drive current to an insulating layer 32, the drive current of a laser diode 34 can be modulated now at high speed, and, thereby, data write-in actuation at a high speed is attained. Moreover, since the npn transistor which is easy to give the property which was excellent on the process can be used as a modulation element and the submounting 33 can moreover also perform heat dissipation of a laser diode 34 good, about especially an optical disk unit like the phase change record for which the current change by the high speed and the high current is needed, it is very advantageous. Moreover, use of the submounting 33 can also perform easily alignment with the optic which makes a laser diode 34 and prism 38 the start.

[0055] In addition, in order to reduce the noise of the laser diode output which poses a problem at the time of read-out of data also about the accumulation mold pickup stated in the 4th example, When the idea which performs the RF superposition stated in the 2nd example can be applied and RF superposition is carried out, by the capacity component between the laser diode 34 and photodiodes 39 and 39 containing an insulating layer 32 Since the high frequency current flows into leakage photodiode 39 and 39 side and the photocurrent of photodiodes 39 and 39 may be able to stop being able to detect correctly, an idea which mitigates the bad influence by the leakage current in the case of the RF superposition stated in the 3rd example is also applicable.

[0056] In addition, this invention also includes the following views.

(6) Using the optical head containing the photodiode formed on the semi-conductor substrate, and the laser diode formed through the insulating layer on said semi-conductor substrate, record an information signal, make the electrode by the side of said insulating layer of the barrier layer of said laser diode into constant potential in the optical information record regenerative apparatus to reproduce, and establish the laser diode driving means which impresses a modulating signal to said insulating layer of the barrier layer of said laser diode, and the electrode by the side of reverse.

[0057] According to this configuration, an operation and effectiveness of claim 1 can be done so.

(7) Establish a means to superimpose the high frequency current on said insulating layer of the barrier layer of said laser diode, and the electrode by the side of reverse, in an optical information record regenerative apparatus given [above-mentioned] in (6).

[0058] According to this configuration, an operation and effectiveness of claim 3 can be done so.

(8) In the optical information record regenerative apparatus of (above-mentioned 6) or above-mentioned (7) publications, it connects with the electrode by the side of said insulating layer of the barrier layer of said laser diode, and establish a capacity means with an electric capacity.

[0059] According to this configuration, it becomes possible further to make it hard to flow to a photodiode through an insulating layer of a modulation current, and quantity of light detection can be correctly performed in a photodiode.

[0060] (9) Make capacity of said capacity means larger than the capacity of said insulating layer in an optical information record regenerative apparatus given [above-mentioned] in (8). According to this configuration, the modulation current which flows to a photodiode can be effectively passed to a capacity means side, and it becomes possible to reduce to extent which does not become removal or the problem of a modulation current of flowing to a photodiode.

[0061] (10) Drive said laser diode in an optical information record regenerative apparatus given [above-mentioned] in a claim (3) with the superposition signal of a direct current signal and said RF signal from a means to impress at the time of playback of an information signal.

[0062] It can be made hard to flow in the RF signal on which it is superimposed at the time of playback of an information signal to an insulating layer according to this configuration.

(11) In an optical information record regenerative apparatus given [above-mentioned] in a claim (3), the signal with which the RF signal of said means to impress modulated said information signal at the time of record is impressed to said laser diode as a modulating signal at the time of playback.

[0063] According to this configuration, a high-speed modulation is attained at the time of record and playback.

(12) Set to an optical information record regenerative apparatus given [above-mentioned] in (5), said laser diode outputs the light beam which carries out incidence to the record medium which an information signal is recorded and is reproduced, and said photodiode detects the reflected light from said record medium.

[0064] According to this configuration, the reflected light from a record medium is

mistaken and it can detect that there is nothing. Therefore, detection of error signals, such as an information signal, and a focal error, a track error, can be made exact.

[0065] (13) In the optical information record regenerative apparatus of (above-mentioned 6) or above-mentioned (12) publications, said photodiode carries out direct detection of the output light from a laser diode.

(14) In the optical information record regenerative apparatus of (above-mentioned 6) or above-mentioned (12) publications, said photodiode detects the light of the direction which is not led to a record medium among the light outputted from a laser diode.

According to such a configuration of (13) and (14), the output of a laser diode is correctly detectable.

[0066]

[Effect of the Invention] Since the electrode by the side of the insulating layer of the barrier layer of the laser diode which was formed through the insulating layer on the semi-conductor substrate according to this invention is made into constant potential as stated above, and it comes to impress a modulating signal to the insulating layer of a barrier layer, and the electrode by the side of reverse Even if it changes the drive current of a laser diode with a modulating signal, that electrical-potential-difference change arises It becomes only the insulating layer of the barrier layer of a laser diode, and an electrode by the side of reverse, and it can be made hard to flow in a RF drive current to an insulating layer, a laser diode can be modulated by this at high speed, and data write-in actuation at a high speed is attained.

[0067] According to this invention, also moreover, by making the electrode by the side of the insulating layer of the barrier layer of a semi-conductor substrate and a laser diode into this potential If the drive current of a laser diode is changed with a modulating signal, that electrical-potential-difference change arises It can be made hard to become only the insulating layer of the barrier layer of a laser diode, and an electrode by the side of reverse, and to flow in a RF drive current to an insulating layer. A laser diode can be similarly modulated with having mentioned above at high speed, data write-in actuation at a high speed is attained, and an equipment configuration can be made simpler by making the both sides of an insulating layer into this potential further.

[0068] Moreover, according to this invention, since the high frequency current can make it hard to flow in to an insulating layer and a RF signal can be efficiently superimposed on a laser diode drive current by establishing a means to superimpose a RF signal on the insulating layer of the barrier layer of a laser diode, and the electrode by the side of reverse, the noise of a laser diode is reduced, it is stabilized and read-out actuation can be performed.

[0069] Moreover, according to this invention, by forming a laser diode directly on an insulating layer, a configuration is possible for an easy thing and can be made in price and cheap. Moreover, according to this invention, by forming a laser diode through conductive submounting on said insulating layer, heat can be radiated good in a laser diode and it is very advantageous about especially an optical disk unit like the phase change record for which the current change by the high speed and the high current is needed.

[Translation done.]